8938

TYPE J, K AND L CARRIER TELEPHONE SYSTEMS
LOCATING GROUNDS ON BALANCED HIGH-FREQUENCY CABLING

CONTENTS PAGE

1. GENERAL

1.01 This section describes the use of the Ground Detector Test Oscillator in checking for the presence of grounds on balanced normally ungrounded carrier frequency circuitry of J, K and L terminal equipment and for the absence of grounds on normally grounded sleeves of jacks. All tests may be made on working systems without interfering with service when made as outlined in Part 3. The ground detector test oscillator may be assembled locally or ordered from the Western Electric Company, 9501 West 67th Street, Merriam, Kansas, as follows:

(Quantity) Oscillator, Test Ground Detector per Dwg. SM16002

1.02 The ground detector consists of a transistor audio frequency oscillator enclosed in a 201A jack mounting equipped with jacks to accept a headset and test cords, and a ground test lead to connect the oscillator to the bay framework. The oscillator will oscillate when its battery circuit is completed externally through resistances of zero to about 50,000 ohms or more between the tip or ring of a test cord inserted in the test cords jacks of the oscillator and the ground test lead. Exceptions to this are discussed in Part 6, Circuit Operation and Diagram.

1.03 The oscillator is arranged so that testing of circuits can be done on a bridging basis when a 3W7A test cord with a 310 plug is inserted in the jack with a yellow ring (Fig. 1A). The bridging resistance is 136,000 ohms. When a shielded patch cord with 305A plugs is inserted in the test cords jacks of the oscillator (Fig. 1B), the test cord is terminated by a nominal 135-ohm resistor in the oscillator.

2. TROUBLES COMMONLY ENCOUNTERED

2.01 The sleeves of the jacks in HF patch bays are normally grounded at the patch bays. Some of the jacks acquire their grounds through wire strappings to the sleeves of other jacks which in turn are grounded through screws and metal straps on the botton front of the insulating block in which the jacks are mounted. If the screws have become loose or severe oxidation of the metal surfaces has taken place, the jack sleeves will not be grounded. A good ground on the sleeves of the group jacks is required when patching, as there will be no ground on the shield of the patch cord if the jacks involved at each end of the patch cord are ungrounded.

2.02 Unwanted ground troubles in the jack field fall into two categories: permanent and conditional. Permanent troubles do not clear out when patching or testing. Conditional troubles mean that a system will become grounded or a ground will be removed when patching or testing, or a system experiences a momentary ground when patching or testing. These troubles may be caused by defective jacks, solder splashes, wiring errors, and insufficient clearance between jack lugs.

2.03 A rare conditional trouble on a jack may occur when a 305A or similar type plug is inserted in a defective jack causing the spring

to rub against the jack frame. The four-fingered 312A plug specified to be used for some of the tests will not flex the springs as much as the 305A-type plug and this conditional trouble may not be detected. However, with the 312A-type plug, the testing can proceed on an in-service basis. Should this conditional trouble be suspected from a visual inspection or from noise developing when the system is patched using a shielded patch cord with 305A plugs, a check can be made for grounds using the test oscillator on a bridging basis on the 305A plugs while the patch is up.

2.04 Conductors of balanced cables may become grounded by cable clips piercing the cables, solder splashes, defective splices, incorrect use of crimping tools and material, and cuts in insulation.

2.05 Other troubles include: defective hybrids and bad filters, solder splashes on terminals of pads, sleeve lug of one jack strapped to tip lug of another jack instead of to the sleeve lug, terminating resistors wired one side to a sleeve lug instead of normals of jacks, and a two-hole metal spacer used in jack instead of a two-hole insulating spacer. Multiple jacks are sometimes incorrectly wired because one pair of jacks is upside down with respect to the other two pairs and the wiring must cross over.

3. GENERAL TESTING PROCEDURE

3.01 ***Preparing the Oscillator for Testing*** (See Fig 1.)

(1) Assemble test oscillator, headset and proper cord.

(2) Shake the cord — if oscillations occur, a conductor of the shielded cord may be shorted to its shield.

(3) Check the cord for continuity by attaching the ground clip first to the tip and then to the ring of the plug and shaking the cord — oscillations should occur and not be interrupted. The frequency of oscillations found in this test may be termed the normal frequency of oscillation when the 305A patch cord is used.

(4) Ground the oscillator to the bay framework by attaching the ground clip to an unpainted screwhead. Test this connection by touching tip or the ring of the plug to an unpainted spot on the framework or another screwhead — oscillations should occur.

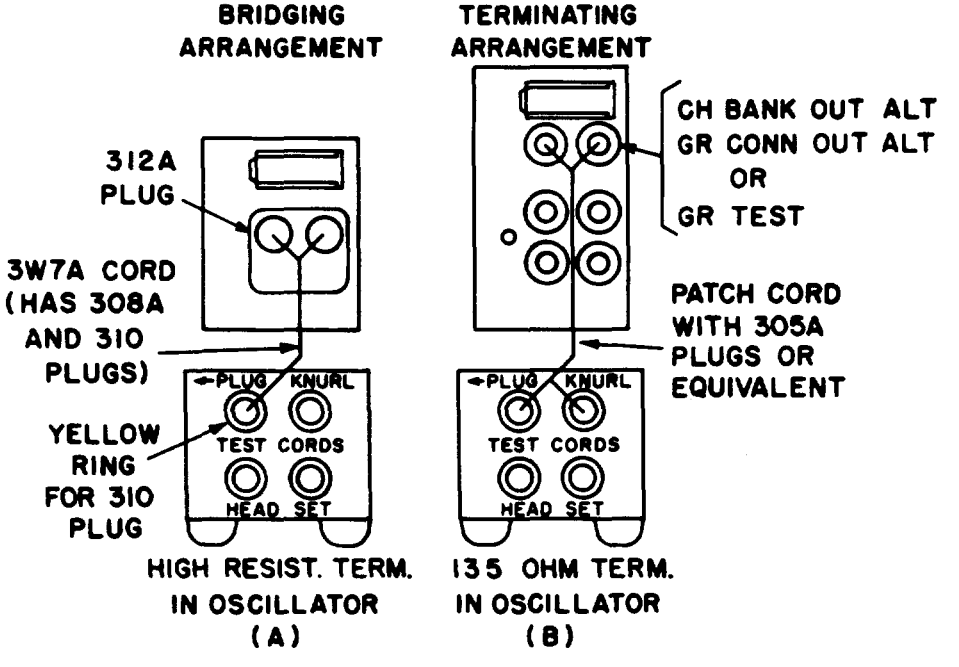


Fig. 1 — Testing Arrangement

3.02 ***Testing of Facilities Using 3W7A Cord and 312A Plug — BRIDGING ARRANGEMENT*** (See Fig. 1 (A).)

(1) This arrangement permits testing, without affecting service, parts of carrier facilities where a 312A plug must be used to provide a bridging connection. The 308A plug of the 3W7A cord is bridged to the 312A plug and the combination inserted in the jacks as a unit. The 312A plug is so designed that it does not break the normal connections of the jacks when it is inserted. The high resistance termination in the oscillator will not affect low impedance circuits.

(2) Touch the ends of the 312A plug to the sleeves of either set of jacks — the oscillator should oscillate at normal frequency if both tip and ring ends touch the sleeves and at somewhat higher frequency if either tip end alone or ring end alone touch the sleeves. If no oscillations occur, the sleeves are not grounded.

(3) Insert the 312A plug into the jack — there should be no oscillations except that a burst of oscillations may be heard, then slowly die away, when the plug first touches the springs of jacks to which considerable capacitance is connected to ground. Do not mistake this for an intermittent trouble.

3.03 ***Testing of Facilities Using Shielded Patch Cord with 305A Plugs — TERMINATING ARRANGEMENT*** (See Fig. 1 (B).)

(1) This arrangement permits testing at the ALTERNATE or GROUP TEST jacks of carrier frequency circuits without affecting service.

(2) Touch the sleeves of the jacks under test with the tip or ring of the plug — oscillations should occur at normal frequency. If the frequency is higher than normal, or no oscillations occur, a high-resistance ground exists, probably because of a loose screw and/or oxidized metal strap on the front of the jack mounting block, or dirty jack sleeves.

(3) Insert the plug into the jacks under test until the tips of the plug are touching the springs of the jack but are not breaking any normal connection in the jack — there should be no oscillations. If oscillations do occur, a trouble exists.

(4) Insert the plug into the jack completely — there should be no oscillations. If oscillations were present in step (3) and have now ceased, the trouble is at the jack, and is either in the jack or the associated terminating resistor is grounded. If oscillations were present in step (3) and are still present after the plug is fully inserted, the trouble may be in the jacks, cabling, or equipment at the far end of the cabling. A careful visual inspection of the jack lugs may indicate the trouble at this location. If oscillations were not present in step (3) but are now present, the trouble is in the jack. See Part 5 for trouble clearing hints.

(5) After a little practice, testing should proceed almost as rapidly as the plug can be inserted and removed from the jack.

3.04 ***Miscellaneous Testing***

(1) Multiple jacks, trunks, cables, test equipment, test coils, and miscellaneous jacks and equipment should be tested with the oscillator. Patch cords may also be tested per Par. 3.01 (2), (3).

(2) The sleeves of certain jacks associated with some trunks and multiple jacks are not required to be grounded. For these cases Par. 3.02 (2) should be modified as follows (all other steps apply): When the tips of the patch cord touch the sleeves of the jacks there will be no oscillations. As the 305A plug is being inserted into the jacks, a point will be reached where the tip and/or ring of the plug may be shorted to the sleeves of the plug by the sleeves of the jack and oscillations will occur. The ground is placed on the sleeves of the jacks via the shield of the patch cord and test oscillator. Further testing should proceed as outlined in Par. 3.02 (3). For multiple jacks an additional step is required: After the plug has been inserted into

the top pair of jacks, touch the ground clip to the sleeves of the bottom pair — there should be no oscillations.

4. TEST POINTS AND PROCEDURES

(A) Type L Terminals and Locations With Group Connectors

4.01 *Apparatus:*

1 — Ground Detector Test Oscillator
1 — Headset, or equivalent
1 — Patch Cord with 305A Plugs

4.02 *Procedure:*

(1) Follow the procedure outlined in Part 3. All testing is done at the HF patch bay. Test all CH BANK OUT ALT, GR CONN OUT ALT, and all GR TEST jacks of working channel banks and connectors.

(2) Test all jacks of spare equipment.

(3) Test all 135-ohm trunks and multiple jacks.

(4) Test jacks of 92 kc amplifier-rectifiers.

(5) Test any other 135-ohm circuits or apparatus, including test equipment.

(B) Type K Terminals

4.03 *Apparatus:*

1 — Ground Detector Test Oscillator
1 — Headset, or equivalent
1 — Patch Cord with 305A Plugs
1 — 3W7A Test Cord from a 30- or 31-Type TMS
1 — 312A Bridging Plug

4.04 *Procedure:*

(1) Follow the procedure outlined in Part 3.

(2) All testing is done at HF patch bay.

(3) Test all CH BANK OUT ALT or GR CONN ALT (CH MBF OUT ALT) jacks by using patch cord with 305A plugs.

(4) Using the 3W7A test cord and 312A plug test GR DEM IN and REC AMP OUT jacks, CH BANK IN or GR CONN IN (CH DBF IN) and GR DEM OUT jacks.

(5) Test all jacks of spare equipment using appropriate cord.

(6) Test any program patch bays which normally have no dc path to ground.

(7) Test all 135-ohm trunks and multiple jacks.

(8) Test any other 135-ohm circuits and apparatus including test equipment.

(C) Type J Terminals

4.05 *Apparatus:*

1 — Ground Detector Test Oscillator
1 — Headset, or equivalent
1 — Patch Cord with 305A Plugs
1 — 3W7A Test Cord from a 30- or 31-Type TMS
1 — 312A Bridging Plug

4.06 *Procedure:*

(1) Follow the procedure outlined in Part 3.

(2) All testing is done at HF patch bay.

(3) Test all CH MBF OUT ALT jacks using a patch cord with 305A plugs.

(4) Using the 3W7A test cord and 312A plug, test LINE and EQPT jacks, CH DBFS IN and GR DEM OUT jacks, CH MBF OUT and GR MOD IN jacks.

(5) Test all jacks of spare equipment using appropriate cord.

(6) Test all 135-ohm trunks and multiple jacks.

(7) Test any other 135-ohm circuits and apparatus including test equipment.

5. TROUBLE LOCATING PROCEDURE HINTS

5.01 Most troubles generally locate in the jack field and usually may be detected by a close visual inspection. If a visual inspection of the jacks reveals nothing, make a visual inspection of the equipment end of the cables including all hybrids and pads.

5.02 If the complete visual inspection reveals nothing, remove all working services from the channel group affected in such a way as to clear both the channel bank or group connector and the group equipment associated with the cabling and jacks concerned.

5.03 After the services have been removed, use a patch cord and the test oscillator to test separately the circuits connected to the channel bank, group connector or the group equipment. Using a patch cord and the test oscillator, determine which side of the patch bay is in trouble by analyzing the condition that causes the oscillator to oscillate.

5.04 Unless the equipment is located in the immediate vicinity of the patch bay, a small dc potential difference will usually exist between the local ground at the patch bay and the local ground at the equipment location. Utilizing this fact, ground trouble may be quickly isolated as to whether the trouble is at the patch bay or the equipment. While using the oscillator as in Par. 4.02 and the oscillator is oscillating because of a ground condition, remove the patch cord from the oscillator and measure the voltage between the tip and sleeve of the patch cord with a KS-14510 volt-ohm-milliammeter using the 0.3-volt scale. If the ground is at the patch bay, there should be zero potential; if the ground is elsewhere, the meter should deflect. For zero potentials the ground should be verified with a resistance check using this meter. The ohmmeter may also be used to determine whether the tip or ring side of the circuit is grounded.

> ***Caution: Where there is a possibility of voltages greater than 0.3 volt between equipment bays and the patch bay, begin with the meter reading on a high voltage scale and work down. If the test oscillator tone is being modulated by ac power characterized by a buzz in the headset, the trouble should not be at the patch bay and the meter test should not be made.***

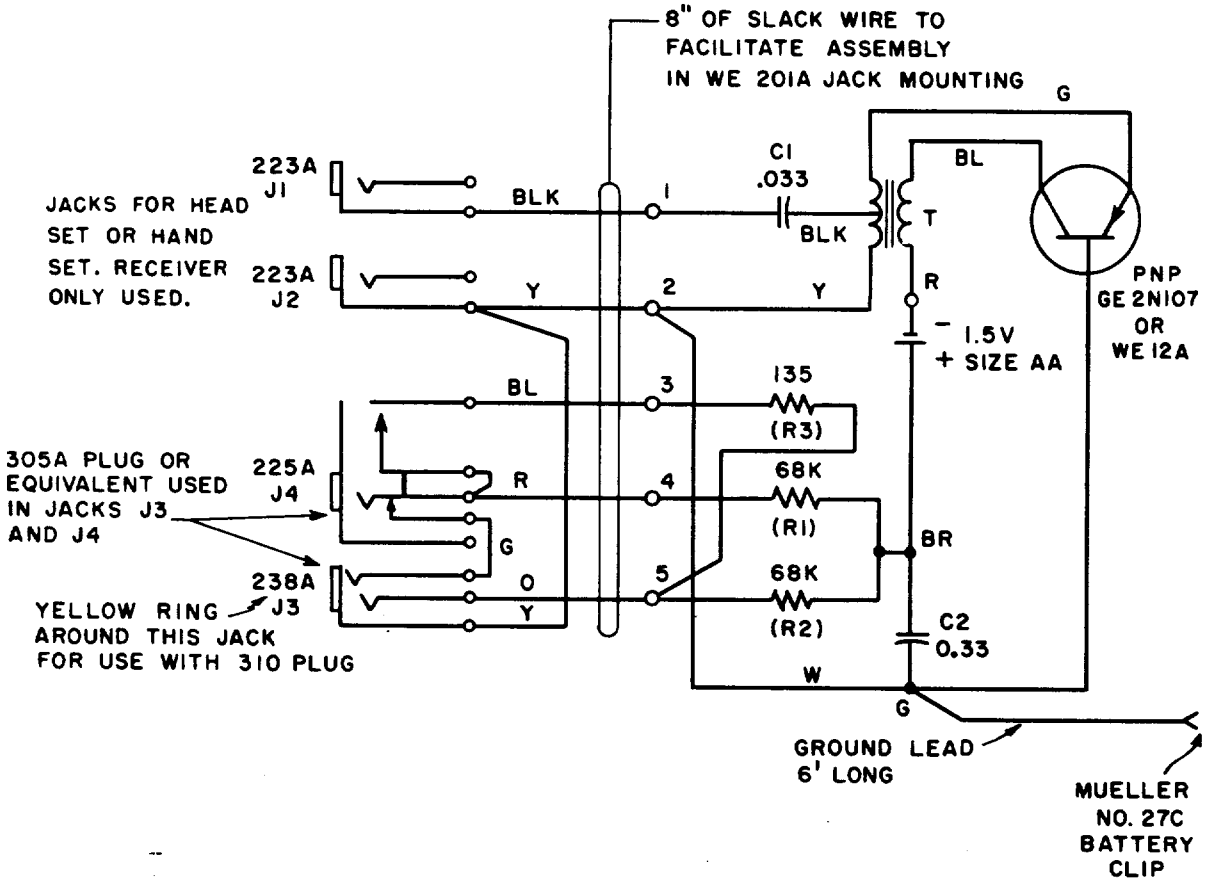
6. CIRCUIT OPERATION AND DIAGRAM

6.01 The circuit diagram of the test oscillator is shown in Fig. 2. The oscillator will oscillate when the battery circuit is completed by connecting the ground clip to the tip or ring of a patch cord inserted in jacks (J3) and (J4), or this circuit is completed through a fault resistance of up to 50,000 ohms or more. The frequency of oscillation is about 700 cycles with a zero resistance fault, and the frequency will increase somewhat for higher resistance faults unless negative battery is superimposed on the fault. In this case the frequency of oscillations decreases as the negative potential increases. The oscillator will not oscillate if positive battery is superimposed on the fault, however, a soft click will be heard in the headset when the external circuit is completed. Positive or negative 130-volt battery superimposed on the fault will not damage the oscillator. The voice-frequency power injected into a metallic circuit by the oscillator, when the fault resistance is zero, is less than —75 dbm for a 900-ohm circuit and —90 dbm for a 135-ohm circuit. The battery current is limited through a zero resistance fault to about 45 or 50 microamperes by the 68,000-ohm resistors (R1) and (R2).

6.02 When a plug is inserted into jack (J4) a terminating resistor of 135 ohms is connected across jacks (J3) and (J4), and resistors (R1) and (R2) are effectively connected in parallel. A two-fingered plug inserted in jacks (J3) and (J4) places a 135-ohm termination on the patch cord which makes it useful for testing on circuits which were designed to be terminated in 135 ohms.

6.03 When the 310 plug of a suitable cord is inserted into jack (J3), which has a yellow ring around it, the other end may be bridged across circuits of as much as 600 or 900 ohms impedance without affecting service. A resistance of 136,000 ohms is bridged across the circuit under test. A resistance of 68,000 ohms is connected between each wire and ground through the transformer (T), the transistor (Q) and the battery from a dc standpoint. From an ac standpoint the 0.33 mfd capacitor (C2) shunts the transformer (T), the transistor (Q) and the battery.

6.04 The oscillating current flows through the external circuit and is limited by the series resistors (R1) and (R2) and the shunt capacitor (C2).



T — Driver Type Transistor Transformer
10,000: 2000 CT Impedance Ratio

C1 & C2 — Mylar Capacitors Style 601PE
50V 446 Good-All Electric Co.

R1, R2 — 1/2 Watt Carbon Resistors

R3 — W. E. Co. 223A Resistor

Fig. 2 — Ground Detector Test Oscillator Circuit Diagram